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Differentiation in the Classroom Using Chromebooks and Google Applications

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Honors Project Thesis

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Introduction:

"There can be infinite uses of the computer and of new age technology, but if teachers themselves are not able to bring it into the classroom and make it work, then it fails" (Kassebaum, N.D.). Nancy Kassebaum relayed exactly what I wanted to achieve with my project: insight into the world of technology in the classroom and connecting it to a main struggle of many teachers: differentiation. Throughout this paper, I will be discussing how I was able to differentiate instruction and assessment through ability and interest assignments using Google Chromebooks and Google applications. Using Chromebooks and Google applications in the classroom can improve engagement, collaboration, and can be used to focus more on individual differentiation within a large groups of students. Differentiation using Chromebooks and Google applications is highly beneficial for student progress and creativity, as well as an efficient way for teachers to help each student as an individual.

Research:

I. Differentiation and Technology

Differentiation is a buzzword in the educational world referring to giving students individualized attention in relation to how they are being taught and assessed in the classroom. Differentiation is not only for those who need more practice and help than others, but also for students who are gifted and need more challenging material. Bravmann states, "Differentiation is the preparation that is made for the curriculum to respond to the characteristic needs of [gifted] children, such as allowing a faster pace of learning and choosing themes and content that allow for more complex investigation" (Bravmann, 2004). Differentiation also does not necessarily have to be done completely individually, but rather through small group settings and can be fluid, meaning that the groupings may change depending on student growth, interest level, subject area, and unit. In my time at Bowling Green State University, I was always told that if you only teach to one ability level of your students, then you will always lose two thirds of the class. According to Ben Johnson, an administrator, author, and educator, "designed differentiation is the deliberate act of modifying instruction or an assignment in order to customize the effect to match the particular developmental level and skills of a student or group of students" (Johnson, 2009). Johnson goes on to give some examples of ways to differentiate in the classroom, including scaffolding the activity in order tier it from easy all the way to hard, giving the students choices on how to complete an assignment, and giving students opportunities to look at feedback and make changes to their work (Johnson, 2009). Later in this paper, you will see that I use all three of these concepts with my students in order to best meet their needs. Often times, teachers believe differentiation is impossible to implement in the classroom. Carol Ann Tomlinson made a solid counterargument against James R. Delisle in her article, "Differentiation Does, in Fact, Work," refuting his statement that only people who have not tried to implement differentiation techniques in the classroom believe it can be done. She then goes on to refute his statement that differentiation is only possible if the classes are ability tracked, which Tomlinson states, " for many reasons, students in lower-track classes don't achieve as well as they do in heterogeneous settings…The intellectual climate in tracker classes is further damped by students who know they are siloed because adults consider them to be less able than many of their peers—and they respond accordingly" (Tomlinson, 2015). As Tomlinson said, by differentiating

within the classroom setting, the label that would have been placed on them by the educational community does not pressure students. Using technology, differentiation can become a much easier route to take than common paper and pencil assignments.

According to Chapter 1 of Grace E. Smith and Stephanie Throne's paper called, "Differentiating Instruction with Technology in K-5 Classrooms", "teachers who apply DI [differentiation] concepts show a willingness not only to learn more about their students but also to modify instruction to support student needs" (Smith, Throne, 2007). Smith and Throne discuss how technology is a highly useful concept for middle school students especially, since they are in such an important phase of their life. Smith and Throne state, "The curricular elements at the core of differentiated instruction (content – input, process – throughput, and product – output) mirror and marry nicely with technology (Smith, Throne, 2009). These authors claim that by personalizing the students' education using technology, a new form of differentiation is created and is not simply an extra aspect of the concept, but rather, something that has melted in with the idea itself (Smith, Throne, 2009). By looking at what students need in terms of groupings, it is possible to differentiate instruction based on age bands – then to grade level – to class sizes – to small groups – and finally to the individual student in any given subject area. This is a struggle for many teachers, but by starting broader, it may be easier to grasp the main concept rather than starting at the individual level.

Differentiation is a constructivist view on education, which allows the teacher to give the students an active role in their education. This also allows the teacher to "make instructional decisions based on student readiness, interests, and learning profile as well as on content, process, and product" (Smith, Throne, 2007). This article goes on to explore six different ways that technology can help with differentiation in the classroom. These six ideas were originally from CARET, the Center for Applied Research in Educational Technology and include, '"technology improves student performance when the application directly supports the curriculum objectives being assessed", "technology improves performance when the application adjusts for student ability and prior experience, and provides feedback to the student and teacher about student performance or progress with the application", and "technology improves performance when used in environments where teachers, the school community, and school and district administrators support the use of technology"' (Smith, Throne, 2007). Technology can be a huge step in the right direction when trying to differentiate in the classroom, especially for a first time teacher or someone who has never really been able to differentiate well before.

II. Google Products

The Google education website shows ways for teachers and administrators to get training for their district, purchase the education package, which includes access to hundreds of educational apps, and Chromebooks, which is Google's version of a laptop. In 2012, over 20 million students and staff members around the world were using Google's Apps for Education after launching the campaign for education technology in 2006. Microsoft has a similar package deal, but has not done as well in school systems as Google (Lardinois, 2012). Chromebooks originally launched in 2011 and were similar to the netbooks that were already being used in schools. The difference between the Chromebooks and netbooks was the use of Google's own operating system: Chrome OS. Google Chrome is a web browser that can hold all of your browsing history and Gmail. Chrome was very different from other browsers such as Internet Explorer and Firefox because the browser could conform to the user by logging on, just like you

would with a regular website. When logging off, no one else can see any of your browser history. Using this technology, Google came up with Google Doc, Drive, Presentation, Sheets, and more that came with the account. According to Tobias Mann, many of the Chromebooks in 2010 were available with 3G and 4G connectivity and they even partnered with Verizon and T-Mobile to provide data (Mann, 2014). Since then, most users connect directly to a Wi-Fi connection, which schools across the nation have installed. Chromebooks became commercially available in 2011 with the Acer AC700 and Samsung Series 5 Chromebook models and came with the option of 3G data from Verizon or standard Wi-Fi connections. In 2012, the Samsung Series 5 550 was released with a higher definition thinner screen at a much higher price. The Samsung Series 3 Chromebook came out at the end of 2012 at a price that was cut in half from the previous Samsung Series 5 550. The Acer 7 and Pixel Perfect in 2013 made its debut at a very high price of $1299.00 (Mann, 2014). For only $250, the Samsung Series 3 Chromebook was a great deal for school districts, especially once Google came up with its educational promotion package. The Samsung Series 3 Chromebook was the series being used in my student teaching placement in the 2014-2015 school year and was the spark for my project idea.

III. Background on Fostoria Intermediate Elementary School and This Project

The school I completed this project in is a small school in Northwest Ohio that recently obtained two carts of Chromebooks; twenty four in each cart. This is equivalent to two class sets for a building containing grades 3-6 with up to seven teachers in one grade level. The Chromebooks are the Samsung Series 3 Chromebooks that ran at $250 back in 2012. This project can be seen as new because through observations and questioning in the school, very few teachers who use the Chromebook applications are aware of any extensions that can be used for administrative and differentiation purposes. I decided to use the Chromebooks for differentiation purposes as well as using the Google applications in order to gain further insight into how this well known technology can be used in the classroom to help both students of different interest and ability levels as well as teachers who struggle with differentiating. My hope is to show other teachers and administrators that through the use of Chromebook and Google application technology, differentiation is in fact possible to achieve in the classroom and show how it benefits the students through methodology, student samples, statistical analysis, and implications for the future.

Methods:

I. Applications Used

I decided to create four different assignments using different Google applications for the students to use. In order to analyze the effectiveness of the results, I created several graphs and student samples. The applications that the students used were: Google Forms, Google Docs, Google Presentation, and Google Sheets. The applications that I used to create and send out the assignments were Doctopus and Google Draw. I categorized the assignments into two groups, which I labeled, “differentiation by interests” and “differentiation by ability.” The students I

worked with were sixth grade low to medium ability level students. I taught the students in the areas of math and science during my student teaching placement at Fostoria Intermediate Elementary School and had two classes, one that contained 23 students and the other, which contained 21 students. The elementary school had two Chromebook carts with 24 Chromebooks in each cart, which allowed each student to have their own Chromebook. Students were able to log into their own Google Drive accounts and with their school Gmail addresses and passwords.

Google Docs is a well-known and the most used application that Google has produced. Essentially, it is a document that allows a person to type information, insert links, text boxes, pictures, and do everything that a Microsoft Word Document or an Apple Pages Document can do. Instead of the document being saved to the hard drive of the computer, it is saved to the Google Drive, which can be accessed through a person's Google Account. All documents are stored in this drive and it can be accessed while online or offline from any computer or device. Documents can be shared with others in order to collaborate, brainstorm, or view other's work and ideas. As someone edits the page, the changes made are automatically displayed on the document in real time, allowing for group work to take place without everyone having to be in one place.

Google Presentation is the Google version of Power Point or Keynote. Just like the Google Doc, Google Presentation is located on the Google Drive account and can be accessed both online and offline on any device or computer. A person can change backgrounds, fonts, formats, add sounds and transitions between slides, and insert pictures and links. The presentation can also be shared with others and everyone can be working on the presentation at one time in different locations. There is also the option of allowing others to view or comment on the presentation. Comments show up on the side of the slide and the person can then reply to the comment.

Google Sheets is the Google version of Microsoft Excel or Apple Numbers. A new spreadsheet can be created using the Google Drive. Again, it can be shared with others and gives the option of viewing, editing, or commenting on the spreadsheet.

Google Forms lets a person create a survey or a quiz and send it out to the public or to certain people. Responses can be seen on the Google Forms toolbar or a spreadsheet on Google Sheets can be created that will hold all the responses to each question given. According to Jennifer Carey, a few ways to use Google Forms for educational purposes would be to collect contact information from students, create short bell ringer or exit ticket activities, formative assessments, and creating rubrics for assignments (Carey, 2014). It is also possible to create quizzes or tests using the variety of answering tools, such as multiple-choice, answer box, extended paragraph response, and more.

Google Draw is a lot like Microsoft Paint and is located on the Google Drive. A person can draw using a variety of tools, create shapes and straight lines, and add text and pictures for editing. These drawings automatically save to the drive and can then be used to upload into a Google Doc, Google Form, or Google Presentation.

Doctopus is an administrative add-on for Google Sheets and is usually used for educational purposes. This extension can be downloaded onto a Chromebook for free from the Google Chrome App Store. Once installed, a person can click the "add-ons" button in the toolbar of Google Sheets and launch the extension. A sidebar appears on the right-hand side of the spreadsheet and asks to create a roster. This roster can be created using a previously created roster, through the use of other applications, or by creating a new roster on the spreadsheet itself. The roster must include the students' first and last names as well as their school Gmail addresses.

The next step is verifying and updating the roster and creating a place for student work to be delivered once completed. Step three sets the sharing arrangements, which gives you four options: individual-all the same, individual-differentiated, project groups, and whole class. This tells you how the assignments will be sent out to the students. This step also gives the option of allowing the students to access other students' assignments, viewing, commenting, or editing capabilities. The assignment that is sent can either be viewed only, commented on only, or edited only by the students receiving the assignment. Student folders can be created so that each student has a folder where all sent assignments arrive and can be completed. Step 4 is where you can choose the assignment template from any of the Google applications on the Chromebook. If it is differentiated, there will be several upload spots directly corresponding to how many groups were created. Step 5 allows you to create or select a folder for all the students' assignments to be sent to in the teacher's Google Drive and gives the option of sending email notifications to the students and including a message along with the email. Finally, in step 6, the extension gives you a summary of all the steps to check to make sure everything is in place before sending. You can then click the "run copy and share" button at the bottom and it will show a progress bar and fill the spreadsheet. Once students begin editing or viewing the assignments, it will show up on the spreadsheet and in the class folders. During the managing and assessing phase of the assignments, a Googbric can be attached, which is another free extension that allows you to create a rubric and have it automatically assess student work by working in conjunction with Doctopus. I did not use this particular application seeing as how it did not fit into my assignment ideas, but will be looking into this extension in the future. Using these applications, I was able to create four differentiated assignments; two of which were assessments, while the other two were in-class assignments.

II. Assignments Created

The first assignment that I created was in the "differentiation by interests" groups. Through the use of Google Presentation, I created an assignment in which the students would research the topics of invertebrate organisms, symmetry, and structure. Within the assignment, I let the students research two different invertebrate organisms that they were able to choose. The students had to create a presentation using Google Presentation to include the definition of an invertebrate organism, what symmetry and structure were when related to an organism, how an invertebrate differed from a vertebrate organism, and research information on two different invertebrates. The information on the invertebrates needed to also include how that organism showed symmetry and what its biological structure was. This could be done through pictures or descriptions. When creating the assignment, I used prior knowledge from previous research assignments to create a project that gave the students more creative autonomy and a focus on their greatest weakness, which was discovering answers on their own. Students were able to choose how they put the presentation together and in what order to put the information in. During the assignment, I only answered questions related to technical issues with the applications or the Chromebooks themselves. The project took three class periods, which resulted in two hours of time for research and the creation of the presentation itself. I walked the students through signing into their school Google Drives and how to create a new presentation. I then explained how I wanted each student to name their presentation and how to send it to my Google Drive. Each student shared their presentation with my Drive and clicked the "Can Comment" button, so that I was only able to make comments on their work and not edit

anything. This way, I could see the students' progress as they worked on their projects and made it easier for me to provide instant feedback to the students.

The second assignment was a self-evaluation of the invertebrate project, which was completed on Google Docs. The students had filled out a paper self-evaluation of the previous group project they had completed and understood what it was before filling it out. For this assignment, I waited until everyone had completed their projects, and then went through each individual project to type comments specific to each student's needs. This assignment was differentiated in the ability category. After typing out my comments, I decided to focus on the main aspects of the project and the individual feedback. I then created a Google Doc with four questions, "What is an invertebrate?" "How will you use the feedback that I have given you in future assignments?" "Name 2 things that you have learned from this project" and "Why is it important to learn about invertebrates?" This information was not only to differentiate the comments for each student, but also to gain information for future instruction on this topic based on their answers for the last two questions. After creating the document, I then used the administrative Google Sheets free add-on: Doctopus. Doctopus is launched with the Google Sheets application, in which you can set up a class roster with students' Gmail accounts. Through the process of setting up the roster, I entered each student's first and last name, as well as their school Gmail address. Then, I was able to set up a folder on my drive where each student's completed assignment would be placed. I set up two different folders; one for each class that I taught. I then selected the assignment I wished to send and determined which students I wanted to send it to. Through the Doctopus extension, I was given the option of selecting certain groups of students to send the assignment to, individuals, whole class, or whole class while excluding certain individuals. For this assignment, I had one student absent, so I chose to send the assignment using the whole class option, and excluded the student who was absent. I then clicked send, and I was able to watch as the assignment was copied and sent to each student in the roster. Students then were able to read their comments by logging onto their Google Drives, clicking on their presentations, and going through each slide to read my comments. After doing so, they went to their "Shared with me" tab, and completed the evaluation form. This time, the students did not need to send their answers to me because through Doctopus, the completed assignments were already located in my own Google Drive.

The next assignment I created was an introduction to spreadsheets for the students. I noticed that during the normal textbook lesson of spreadsheets, the students were supposed to be able to read and comprehend the different parts of a spreadsheet and be able to make calculations based on one situation, simply by looking at a screen capture of a spreadsheet of a picnic in the Everyday Mathematics series. The lesson took no longer than thirty minutes to complete. Instead of moving on to the next lesson, I decided to use the Chromebooks to have the students create their own spreadsheets and learn about the formulas and calculations needed in a more hands-on manner. I decided to differentiate this lesson in the interest category for one of my classes, and in the interest and ability category for my other class. Using a Google Doc and Doctopus, I typed out instructions for creating a spreadsheet using Google Sheets. Since this assignment was to be completed right before Spring Break, the prompt for the students was: "You are going shopping over Spring Break and you have a list of eight items you would like to purchase. Name any eight items you would like to buy, how many of each item you are going to buy, the price of the item, and calculate how much money you would need in order to buy each type of item." This way, the students were able to explore creating the different parts of a spreadsheet using something they personally were interested in, and understand the calculations that go into it. For the other class, I

noticed that they tend to struggle with inquiry experiences more than the other class, so I had them work in pairs, in which each student still had their own Chromebook, but they were able to troubleshoot with their partner and help each other explore the Google Sheets application. Again, through the use of Doctopus, I was able to send the assignment as a whole class. This time, the students needed to create their own Google Sheet so they had to share their spreadsheets with my Google account using the "Can View" option on the sharing button.

The last assignment was a tiered math quiz for one of my classes and fit into the ability differentiation category. The students usually take five or six question quizzes over one or two sections of the math unit every couple of days. These quizzes are standard for every student and usually require the students to solve math application problems and write their answers on the lines provided. After looking over the students' homework and in-class assignments over using the area formula of a circle, I was able to divide the students into three groups, which I labeled: readiness, on-target, and enrichment. I found that six students needed to be placed in the readiness group and upon further inspection, struggled with remembering the formula and coming up with answers on their own. For this group, the first question was, "What is the area formula for a circle?" This way, they would be prompted to think about the formula of a circle before solving any problems dealing with area. They could then refer back to the formula they had written to solve the next set of problems. I also made two out of the four area problems multiple-choice responses. Each question contained mostly whole numbers for a more appropriately leveled set of problems. I provided picture representations of the circle with the labeled radius or diameter and used age appropriate story problems to relate to the students. In the last question, I used the school's basketball team as an example because most of the students in the readiness group were basketball cheerleaders or very interested in basketball. For the visuals, I used the Google Draw application, which allowed me to create perfect circles and straight lines. I was then able to label these pictures, take screen captures of them, and easily upload them into Google Forms. Google Forms is usually not used for test taking, but rather, is more known for surveys. To create the test on Google Forms, I created a quiz title and general instructions for the quiz. Then I was able to add questions and select the answer type that I wanted, which could include, short response, extended paragraph response, multiple-choice, and several others. I was able to use the toolbar to insert pictures and drag them underneath the correct question.

The second quiz was for the enrichment group and there were four students who I felt were qualified to take this quiz. This quiz had the same number of questions, but was a little more challenging. The questions contained decimals and a more in depth extended response question: "Explain how you find the area of the circle. Make sure to state your answer to the nearest tenth." This way, they can focus on the process of how to solve the problem. The two application problems required a greater understanding of the area formula for a circle and greater problem solving skills. I was able to create and upload pictures into the Google Form through Google Draw, just as I did with the readiness quiz.

Finally, the third quiz contained the majority of the class with eleven students, which I labeled as on-target. Unlike the readiness group, every answer required either a short response answer box or an extended response. The questions contained both whole numbers and decimals and while many of the questions contained a visual representation, there was one question with only a description of the circle. This group of students was also very interested in athletics, so I decided to make the application problem about baseball. Since these students are going into

seventh grade at the Junior and Senior High School in the following year, I chose to use their baseball team as an example in order to relate to the students.

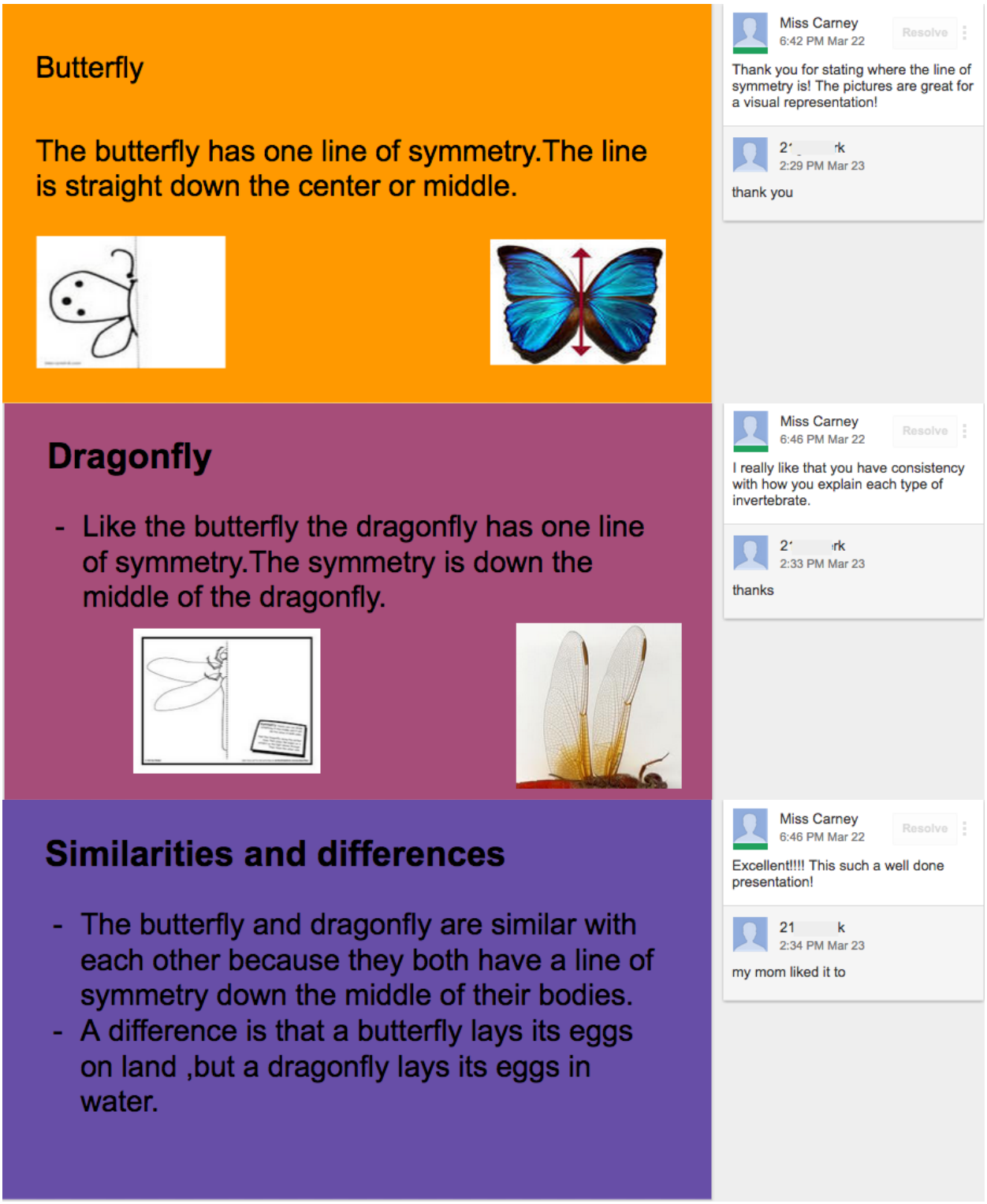
I then created three different Google Docs with short instructions on how to complete the quiz and a link to the quiz. Each of the documents contained one of the three links. Then, using Doctopus, I was able to select the Differentiate By Groups option. This created a new cell in the roster spreadsheet with different letters. I was able to go through the roster and type in the correct letter for each student that would determine which group they were in. Since there were three quizzes, I created three groups: A for readiness, B for on-target, and C for enrichment. After typing in the corresponding letter next to each student's name, Doctopus allowed me to select the document that would be sent to each member of their allocated group. For group A, I selected the readiness Google Doc containing the link to Google Form 1, for group B, I selected the on-target Google Doc containing the link to Google Form 3, and for group C, I selected the enrichment Google Doc containing the link to Google Form 2. Finally, I was able to send out the correct documents to all the students at once. When the students took the quiz, none of them were aware of which group they had been placed in and once the students had completed their quiz, they clicked the "submit" button at the bottom of the page, and a box came up letting them know that they had completed the form and were unable to go back to make any other changes. If I had decided to let the students go back and make further changes, I could have made that option available through the settings on the Google Form. All of these assignments led to some very intriguing results regarding student progress and the benefits of differentiation.

Results:

I. Assignment 1: Invertebrate Project

The first assignment that the students completed was the invertebrate project using Google Presentation. The students were very excited to work with the Chromebooks and create their own presentations, but still seemed to struggle with the technology. The students had never worked with the Chromebooks using Google applications before and had only ever been given the opportunity to use the Chromebooks for research or other interactive websites. Knowing this, I began the first day with a brief rundown of how to use the different tools and showed the students an example a project of my own creation using the SmartBoard and my own Google account. The students were given three days to research and create a presentation using Google Presentation.

Student N usually did not like science and produced C work in science class. During this project, she not only completed the project on time, she also worked on it over the weekend, giving great explanations and details and ultimately receiving a 110%. Student Kay is an A+ student and did very well using the technology and shortcuts of the Google application. Samples of her work can be seen below:

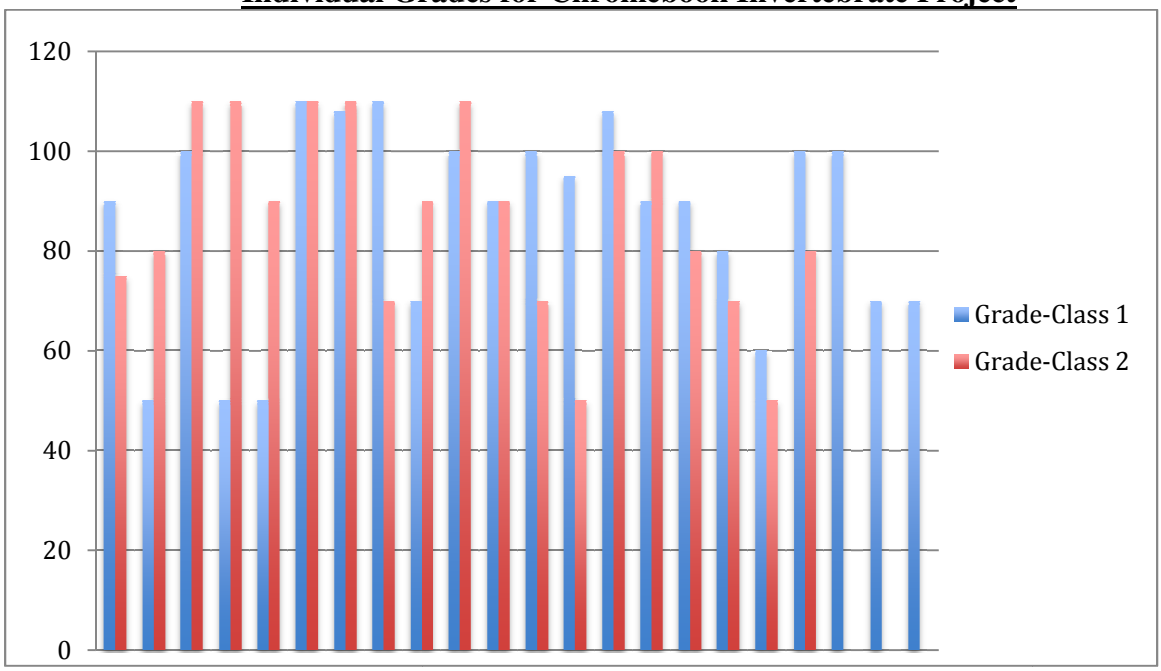


When looking at the standards for this lesson, the science standard being assessed were Life Science: Cellular to Multicellular: Living systems at all levels of organization demonstrate the complementary nature of structure and function. The key concepts I was assessing were symmetry, structure, and body systems of organisms other than humans. The learning objectives were: Students will be able to define symmetry, structure, and invertebrate through research,

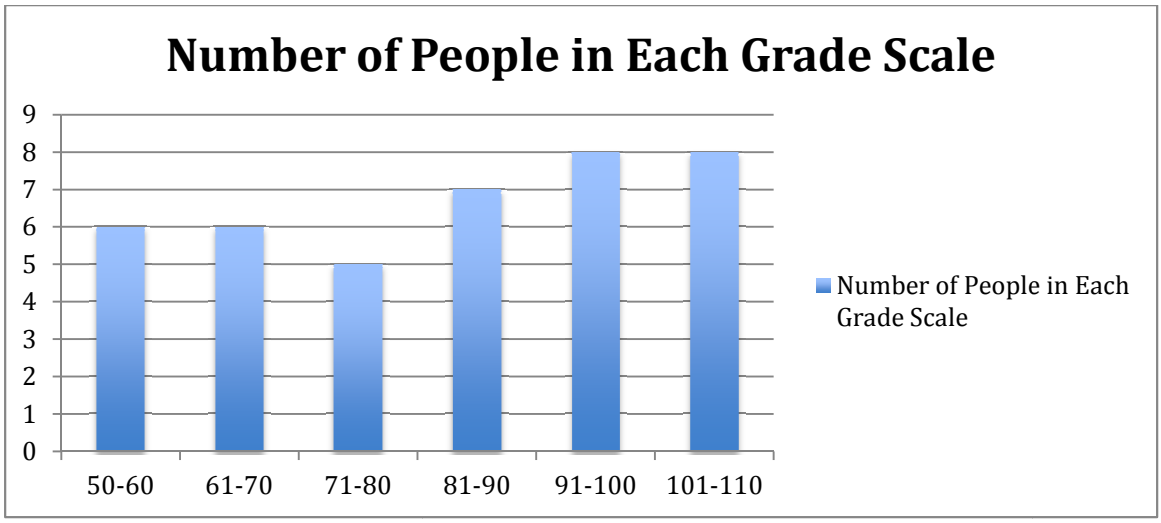
Students will be able to compare and contrast different invertebrate organisms, and Students will be able to create a presentation displaying all information about invertebrate organisms. I decided that my students should be able to complete these tasks with 90% accuracy. The technology standards being assessed were: Creativity and innovation: b. Create original works as a means of personal or group expression, c. Use models and simulations to explore complex systems and issues, Research and information fluency: b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media, d. Process data and report results, and Technology operations and concepts: b. Select and use applications effectively and productively. These standards were connected directly to the students' science standards and I decided that since my students had not used Chromebooks for the Google applications previously, that they only needed to complete these tasks with 80% accuracy.

Below is a chart displaying the grades of every student that was present to complete the project. Those who went above and beyond and researched more than two invertebrates could earn up to ten extra credit points towards the assignment.

Individual Grades for Chromebook Invertebrate Project

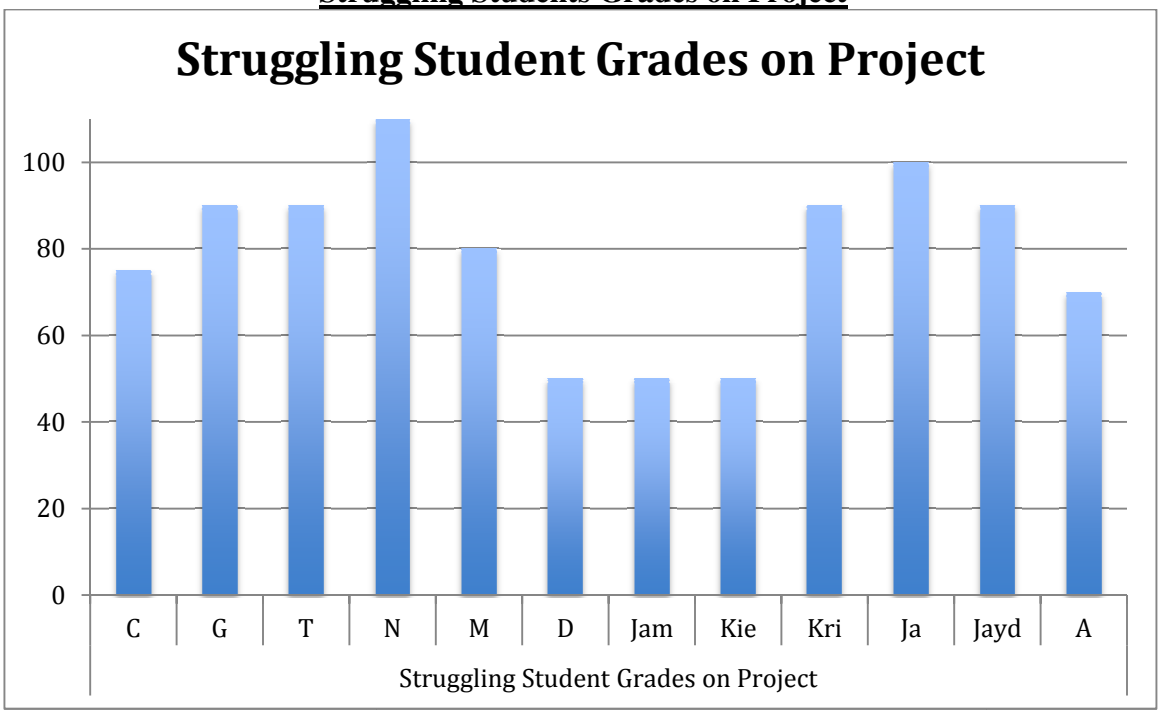


This graph shows the individual grades that every student received on the project. Grades were based on the presence and correctness of all information. The average percentage rounded to the nearest tenth of a percent for Class 1 was 86%, while the average for Class 2 was 86.6%. In relation to the learning objectives, 40 out of 41 students (97%) were able to accurately define the term, invertebrate, 32 out of 41 students (78%) were able to accurately define the term, structure, in relation to biology, and 36 out of 41 students (88%) were able to accurately define the term, symmetry, in relation to biology. 37 out of 41 students (90%) were able to make correct comparisons between their two invertebrates of choice. Finally, there were 24 students who received a grade of a 90% or above out of 41 students, which is over half (59%).



This graph displays the number of students that received grades within the given grade scale ranges for Class 1 and 2 combined. The highest ranges were tied between 91-100 and 101-110 with eight people in each range, while the lowest range was 71-80 with only five people. 50-60 and 61-70 were tied for second lowest with six people in each category, and the second highest category was 81-90 with seven people.

Struggling Students Grades on Project



This graph shows the grades of students who usually struggle in science. To protect the privacy of the students, each student's name was shortened to the first to fourth letter of their name. With

3 out of the 12 students receiving 50% as their grade, the overall average was 78.8% for these students, which is a vast improvement from their previous work. The main issues that I saw in these students' work was a lack of information and/or incorrect definitions of words. This project was differentiating instruction and assessment with differing interests. Because each student was able to produce their own work how they wanted to create it and research two invertebrate organisms of their choice, student engagement was much higher.

II. Assignment 2: Evaluation of Invertebrate Project

This assignment was brief and connected to the previously mentioned science standards. A new learning objective was added, which included: Students will be able to write how they will use the teacher's feedback in the future. This would be done to 90% accuracy since the students had only ever done self-evaluations once before this assignment. The students answered four questions dealing with their invertebrate projects, which I commented on. Most comments that I wrote dealt with stating the information in the students' own words, formatting issues such as text going off the slide, incorrect definitions of the words symmetry and structure, and suggestions for using bulleted and numbered lists to list the important details. Below is a student sample of the completed evaluation and comments made on the project.

Student AL Response

Go through the comments on your Google Presentation for Invertebrates. Answer the following questions, once you have reviewed the comments.

What is an invertebrate?

An invertebrate is an animal lacking backbone. :)

How will you use the feedback that I have given you in future assignments?
I will follow the directions you gave me to make it better

Names 2 things that you have learned from this project.

1.I have learned about invertebrates and what it is

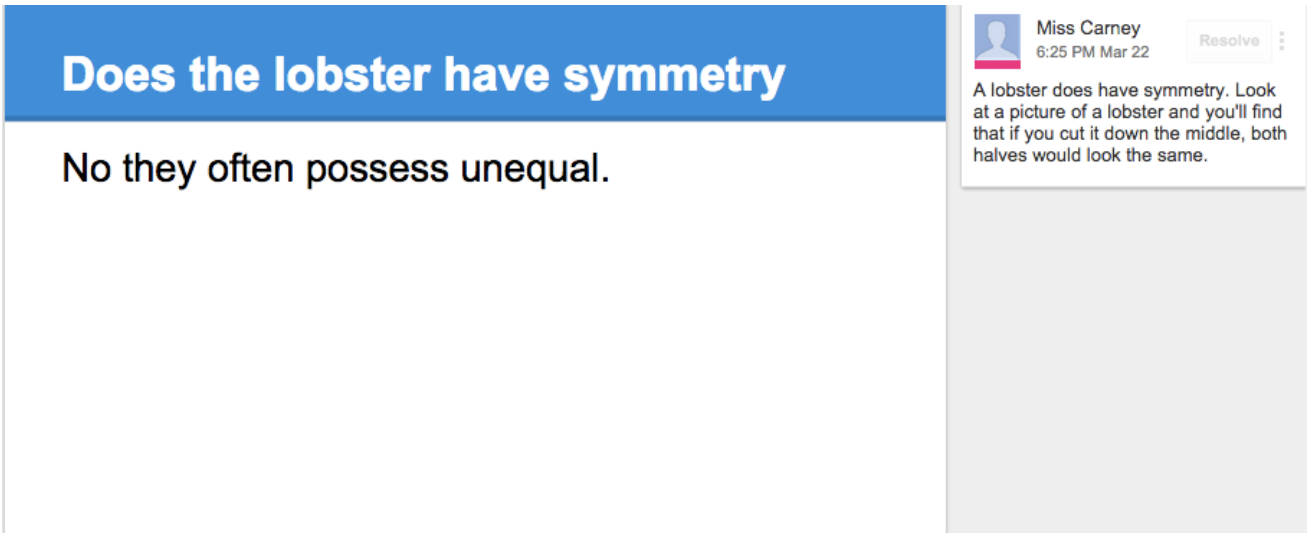
2.
I also learned more about lobsters

Why is it important to learn about invertebrates?

LEARNING ABOUT INVERTEBRATES IS IMPORTANT BECAUSE IF YOU WANT TO GO TO COLLEGE FOR THAT IT IS VERY IMPORTANT. :)

Student Al stated the correct definition of an invertebrate and while she did not describe the feedback that I gave her, she said she would use it to make it better in the future. Her response to

the last question reads: “Learning about invertebrates is important because if you want to go to college for that it is very important.” Below are the comments I made on AL’s presentation:



These are samples of the kinds of comments I was able to make on each student's project. I was able to use the comments and this assignment to differentiate my instruction and provide meaningful feedback in a timely manner. Each student was able to use these comments to think about how they would move forward in future projects and assignments.

III. Assignment 3: Google Sheets Assignment

This assignment had the students create their own spreadsheet using a prompt that differentiated instruction by interest. The math standards were: 6.RP.3.a: Use Ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations, and 6.EE.9: Represent and analyze quantitative relationships between dependent and independent variables. The learning objectives were: The students will be able to write formulas using spreadsheet cell names, The students will be able to evaluate algebraic expressions and formulas, and Students will be able to apply the distributive property to solve an equation in one variable. To begin, I gave the students the original lesson on spreadsheets from Everyday Math Journal Volume 2 as seen below. Every student was to complete this page in the same manner while I gave direct instruction and used Socratic questioning to help guide the students. Before the lesson, I gave a short pre-assessment simply by asking the students what they knew about spreadsheets and if they had ever used a spreadsheet like Excel or Numbers. In both classes, none of the students had ever used a spreadsheet or knew anything about them. Knowing this, I tried to give students time to ask questions as we went through the page. At the end of the lesson, I asked the student to give me a "hidden thumbs-up," which is our class's way showing how they feel about that day's lesson. The majority of the students gave me a thumbs-down response, showing me that I needed to take a different route to help my students succeed.

Date Time

LESSON 9•7

A Picnic Budget Spreadsheet

The following spreadsheet gives budget information for a class picnic.

Class Picnic ($)

	A	B	C	D
1		budget for class picnic		
2				
3	quantity	food items	unit price	cost
4	6	packages of hamburgers	2.79	16.74
5	5	packages of hamburger buns	1.29	6.45
6	3	bags of potato chips	3.12	9.36
7	3	quarts of macaroni salad	4.50	13.50
8	4	bottles of soft drinks	1.69	6.76
9			subtotal	52.81
10			8% tax	4.23
11			total	57.04

1. What information is shown in Row 8?

   _____

2. What information is shown in column A—labels, numbers, or formulas? _____

3. Cell D6 holds the following formula: = A6 * C6.

   a. What formula is stored in cell D4? _____

   b. What formula is stored in cell D8? _____

4. Circle the formula stored in cell D9.

   = C4 + C5 + C6 + C7 + C8 = D4 + D5 + D6 + D7 + D8

5. a. What does the formula stored in cell D10 calculate? _____

   b. Circle the formula stored in cell D10.

   = 0.08 * C9 = 0.08 * D9 = 8 * D9

6. a. What does the formula stored in cell D11 calculate? _____

   b. Write the formula stored in cell D11. _____

7. a. Which spreadsheet cells would change if you increased the number of bags of potato chips to 4? _____

   b. Calculate the number that would be shown in each of these cells.

   _____

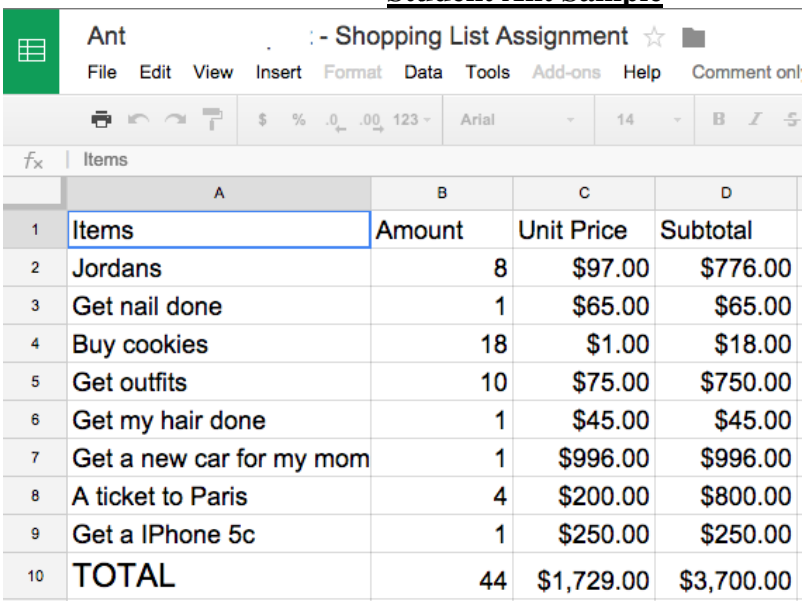
343

This worksheet is from the McGraw Hill Everyday Math Online website.

Without differentiating my instruction, the lesson did not meet the learning objectives for any of my students. I decided to create an interest-differentiated assignment in which the students would

create a spreadsheet looking at eight items that they would want to buy over Spring Break. I decided to walk the students through how to create a spreadsheet by creating my own along with the students on the SmartBoard and going through each step together, while they added in their own items. The technology standards used were: Creativity and innovation: a. Apply existing knowledge to generate new ideas, products, or processes, Research and information fluency: d. Process data and report results, Critical thinking, problem solving, and decision making: d. Use multiple processes and diverse perspectives to explore alternative solutions, and Technology operations and concepts: b. Select and use applications effectively and productively. A female student sample from Student Ant and a sample from a male student from Student Ej are provided below.

Student Ant Sample



	A	B	C	D
1	Items	Amount	Unit Price	Subtotal
2	Jordans	8	$97.00	$776.00
3	Get nail done	1	$65.00	$65.00
4	Buy cookies	18	$1.00	$18.00
5	Get outfits	10	$75.00	$750.00
6	Get my hair done	1	$45.00	$45.00
7	Get a new car for my mom	1	$996.00	$996.00
8	A ticket to Paris	4	$200.00	$800.00
9	Get a IPhone 5c	1	$250.00	$250.00
10	TOTAL	44	$1,729.00	$3,700.00

Student Ej Sample

ej shopping list assignment

File Edit View Insert Format Data Tools Add-ons H

$ % .0 .00 123 Arial 10

Items

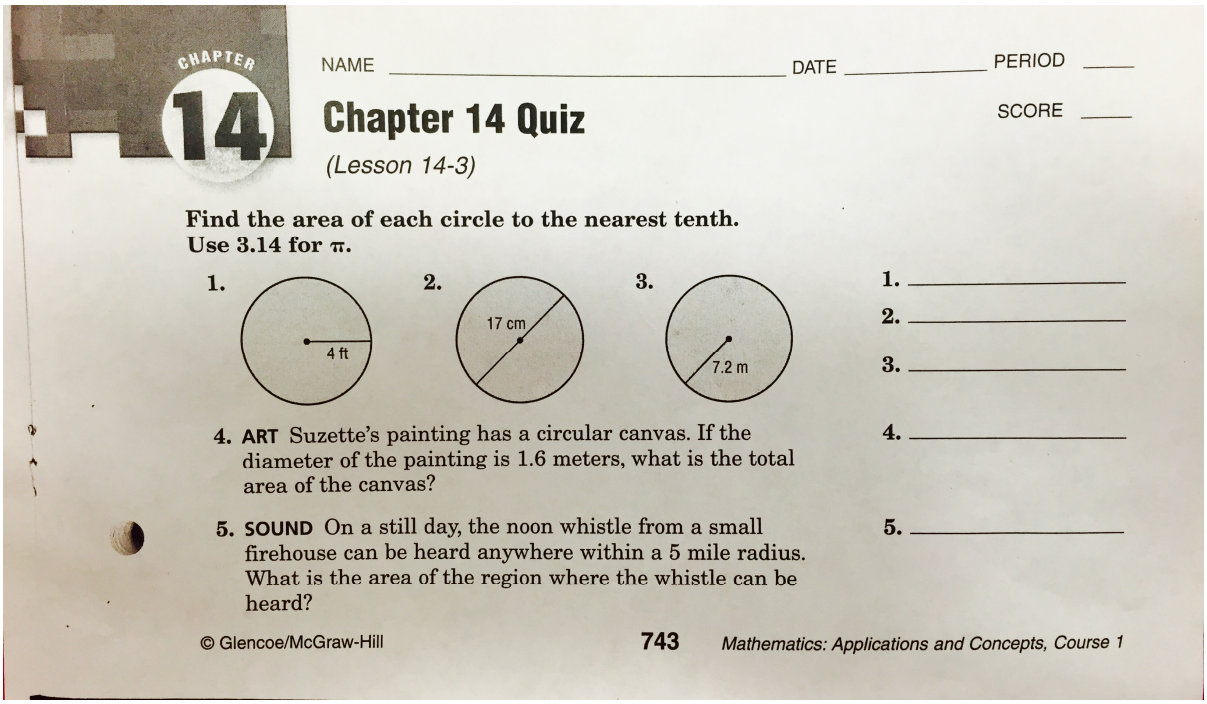
	A	B	C	D
1	Items	Amount	Unit Price	Subtotal
2	Gummy Worms	2	$1.00	$2.00
3	Joggers	4	$25.00	$100.00
4	Shoes	4	$200	$800
5	Basketball	1	$20.00	$20.00
6	Bed	1	$60	$60
7	Eliete socks	10	$16.00	$160.00
8	Cleat	1	$150.00	$150.00
9	Football gloves	3	$20.00	$60.00
10	Ps4	1	$200.00	$200.00
11	**TOTAL**	27	$692.00	$1,552.00

The students were engaged for the entire lesson and thought critically about how to figure out how much money they would need in order to purchase the items that they wanted. The students manually typed in equations and then learned about the shortcut SUM formula. By the end of the lesson the students were comparing their final amounts with their peers. I then gave another quick formative assessment at the end of the lesson, asking the students how they felt after using Google Sheets. The majority of the class gave thumbs-up, while the other few students gave sideways thumbs. I expected the students to be able to achieve the standards and learning objectives with 85% accuracy and I believe the students succeeded.

IV. Assignment 4: Tiered Math Quiz

My final assignment for the students was a tiered math quiz on the area of a circle, which I decided to differentiate an assessment based on ability level. The math standard being assessed was 6.GA.A.1: Solve real-world and mathematical problems involving area, surface area, and volume. The learning objectives being assessed were: The students will be able to solve area problems related to the area formula of a circle, and the students will be able to apply the area formula to real world problems. These objectives were to be met with 85% accuracy. The technology standards being assessed were Research and information fluency: d. Process data and report results, and Technology operations and concepts: a. Understand and use technology systems. Using the students' in-class work and homework assignments on the area of a circle, I was able to group the students into three categories: readiness, on-target, and enrichment. I noticed that the main struggle with the students in the readiness group was remembering the formula and applying it to different problems. The on-target group needed more practice with stating the solution to their answers with correct units and also needed to practice explaining their answers. The enrichment group needed more challenging problem solver questions that would allow them to take the formula and apply it in a more in depth manner. For this unit, we were using the Glencoe Mathematics Book, which contained a Chapter 14 Lesson 14-3 quiz.

This quiz was what the students were originally supposed to take and was not differentiated in any way. This quiz can be seen below.



CHAPTER 14

NAME _____ DATE _____ PERIOD ____

SCORE ____

Chapter 14 Quiz

(Lesson 14-3)

Find the area of each circle to the nearest tenth. Use 3.14 for π.

1.

2.

3.

1. _____
2. _____
3. _____

4. **ART** Suzette's painting has a circular canvas. If the diameter of the painting is 1.6 meters, what is the total area of the canvas?

4. _____

5. **SOUND** On a still day, the noon whistle from a small firehouse can be heard anywhere within a 5 mile radius. What is the area of the region where the whistle can be heard?

5. _____

Scan from Glencoe Mathematics Course 1 Activity book.

I noticed that while the visual representations were perfect for problems one through three, the two story problems would be easily related to my students' interests. Previously in the year, I had constructed a math quiz that was based entirely on the students' interest surveys that I gave them at the beginning of the year. The improvement on grades was astounding, so I decided to do the same thing. The students are very interested in athletics and enjoying time with their friends, so all of the story problems dealt with these two concepts. The blank version of each quiz can be seen below, starting with the readiness group.

Readiness Quiz

Page 1 of 1

Area of a Circle Form 1

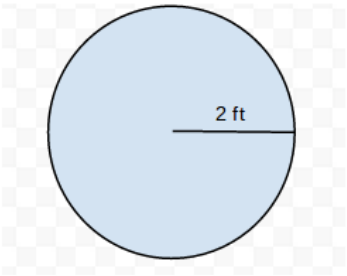
Read the questions and answer either by typing your response in the boxes, or choosing the best multiple choice response. Round all answers to the nearest tenth. Use the information: π = 3.14.

What is your name?*

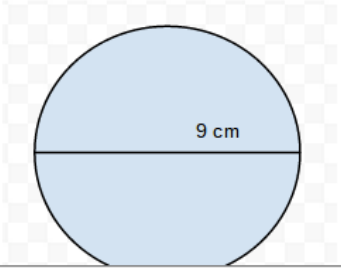
What is the area formula for a circle?*
π can be written as pi

Look at the picture below and find the area of the circle to the nearest tenth.*

- ○ 12.5 square feet
- ○ 32.4 square feet
- ○ 12.6 square feet
- ○ 3.1 square feet



Look at the picture below and find the area of the circle to the nearest tenth.*



You and your friends are having a party and one of the party games is finding the area of different objects. You measure the pizza you ordered and find that it has a radius of 8 in. What is the area of the entire pizza?*
Round to the nearest tenth.

- ○ 50.2 square inches
- ○ 25.1 square inches
- ○ 201.0 square inches
- ○ 33.5 square inches

Fostoria Intermediate Elementary is going to paint the center circle of the basketball court with red paint. The circle has a diameter of 4 feet. What is the area that will be painted red?*
Round to the nearest tenth.

On-Target Quiz

Area of a Circle Form 3

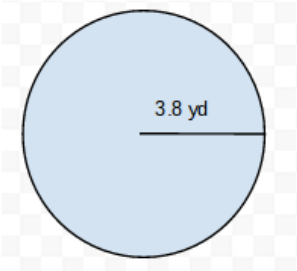
Read the questions and answer either by typing your response in the boxes, or choosing the best multiple choice response. Round all answers to the nearest tenth. Use the information: π = 3.14.

* Required

What is your name? *

Using the picture below, find the area of the circle? *

- ○ 181.4 square yards
- ○ 7.6 square yards
- ○ 45.3 square yards
- ○ 23.9 square yards

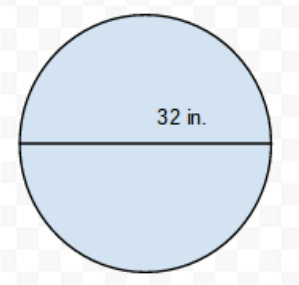


Explain how you came up with your answer to the previous question. *
You can use the word "pi" to refer to π

Find the area of a circle with a diameter of 15 meters. *

Round your answer to the nearest tenth.

Look at the picture below. What is the area of the circle to the nearest tenth? *



The pitcher's mound on the Fostoria Junior and Senior High School field has a radius of 9 feet. What is the area of the pitcher's mound? *

Round to the nearest tenth.

Submit

100%: You made it.

Never submit passwords through Google Forms.

Enrichment Quiz

Area of a Circle Form 2

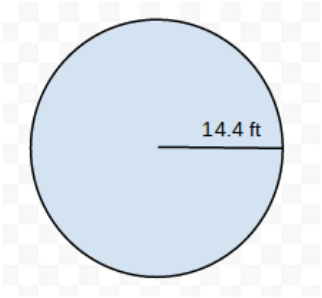
Read the questions and answer either by typing your response in the boxes, or choosing the best multiple choice response. Round all answers to the nearest tenth. Use the information: π = 3.14.

* Required

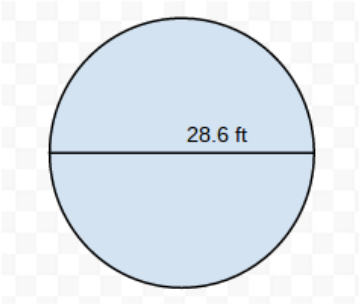
What is your name? *

Use the picture below to find the area of the circle to the nearest tenth. *

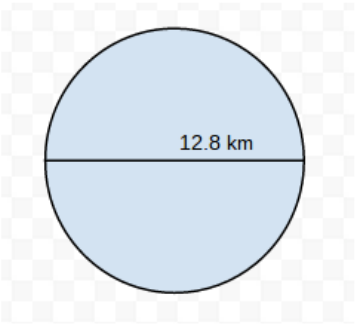
- 207.4 square feet
- 162.8 square feet
- 51.8 square feet
- 651.1 square feet



Use the picture below to find the area of the circle to the nearest tenth. Type your answer in the textbox below. *



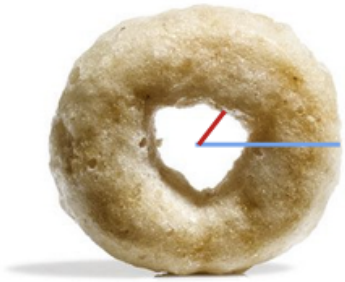
Using the picture below, explain how you find the area of the circle. Make sure to state your answer to the nearest tenth. *



You need a new cover for you circular pool. The pool has a radius of 24.5 feet and is 5 feet deep. What is the area of the cover that you will need for your pool? *

Round to the nearest tenth.

Using the information below about the Cheerio, figure out what the area of just the Cheerio is without the empty space in the middle. *



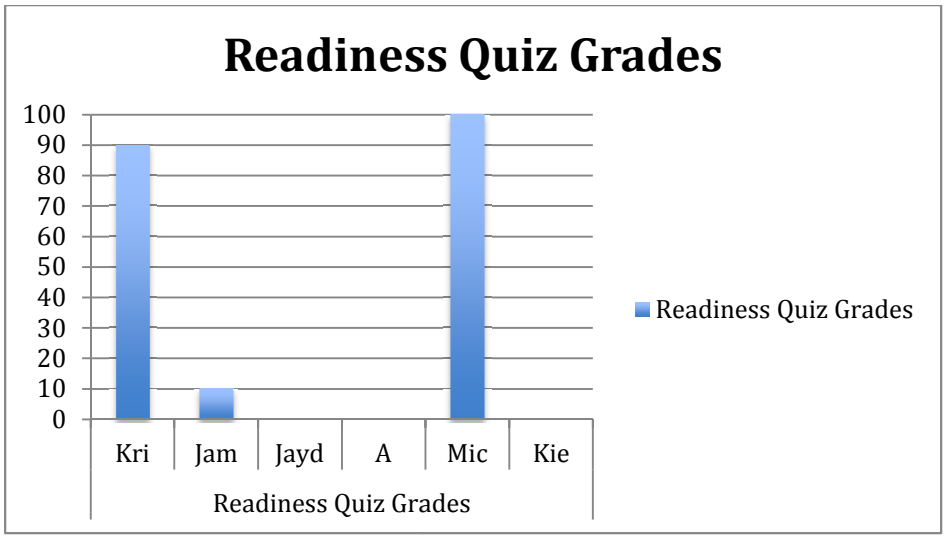
The radius of the center of the Cheerio is 5 mm. The radius from the center to the edge of the Cheerio is 10 mm.

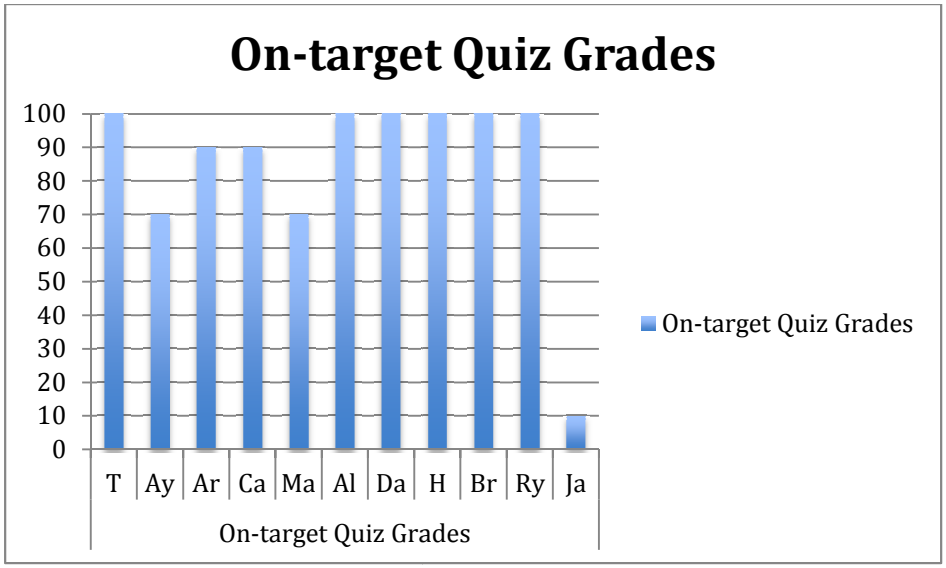
Submit

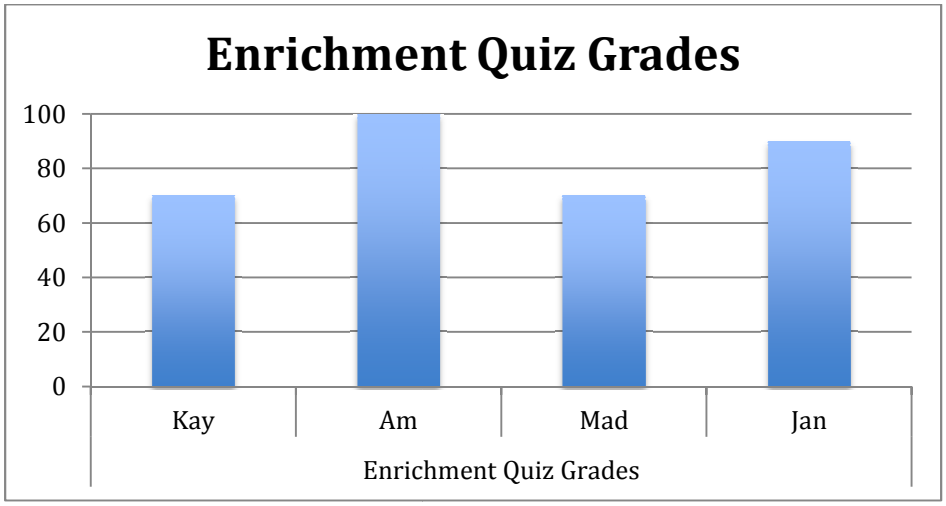
Never submit passwords through Google Forms.

100%: You made it.

The results were then displayed on a Spreadsheet connected to the Google Form for grading purposes. Below are the grade results of the quiz.


Readiness Quiz Grades
100
90
80
70
60
50
40
30
20
10
0
Kri
Jam
Jayd
A
Mic
Kie
Readiness Quiz Grades
Readiness Quiz Grades


On-target Quiz Grades
100
90
80
70
60
50
40
30
20
10
0
T
Ay
Ar
Ca
Ma
Al
Da
H
Br
Ry
Ja
On-target Quiz Grades
On-target Quiz Grades


Enrichment Quiz Grades
100
80
60
40
20
0
Kay
Am
Mad
Jan
Enrichment Quiz Grades

Overall, the students in the on-target group ended up with the better grades and the readiness group did not do as well as I had hoped. The overall average percent for the readiness group was a 33.3%, while the average in the on-target group was 84.5%. The average percent in the enrichment group was an 82.5%. I noted that none of the groups accomplished the 85% accuracy goal, but several individual students accomplished the learning objectives with this accuracy. These results led to several implications in how to use this technology to further differentiate assessments and instruction in the classroom.

Implications:

Each of these assignments gave me further insight into how to use the Google applications on Chromebooks to differentiate my instruction and assessments for students with different abilities and interests. The first project was very successful in giving the students more autonomy to be creative and differentiate through their interests in different organisms as well as differentiate the feedback I gave them on each slide. I was easily able to connect this assignment to technology and science standards as well as assess whether or not the standards had been met. Student engagement was very high throughout the three-day assignment and I had several students complete more than they were asked to and work on it outside of class. Differentiation includes giving students individual attention to best meet their needs and by giving them comments on their project, each student was able to learn from their mistakes and be proud of their strengths. The Google Presentation application's commenting option made it very easy for me to make quick comments on every student's project and made it easy for the students to read and respond to my comments.

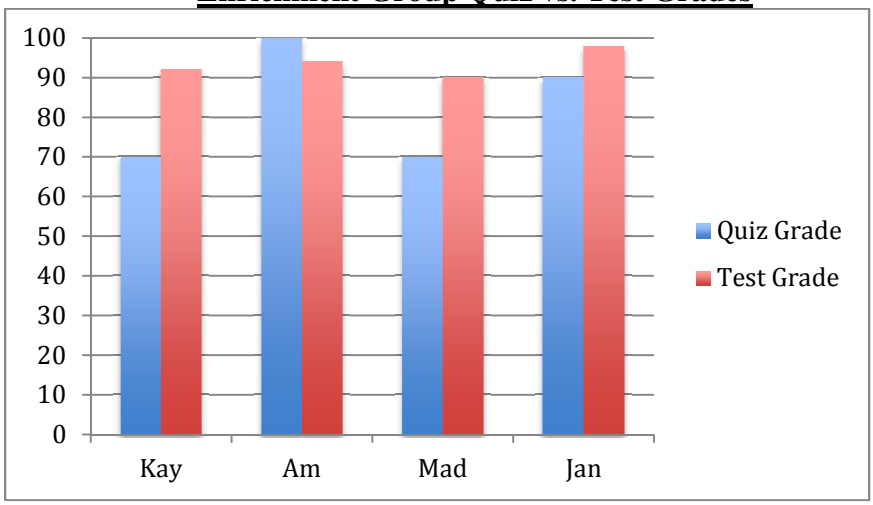
The second assignment with Google Docs went fairly well, but I still wanted the students to think more critically. They tend not to want to write in complete sentences and paragraphs so I thought by giving them an opportunity to type out their answers they would be more engaged. I also thought it would be easier for some of them to type than to write, but I still received very short five or six word sentence responses. None of the answers were really well thought out. The use of Doctopus was very easy to implement and a big time saver in sending out instructions and assignments. If I were to do this assignment over again, I would be sure to have a minimum sentence requirement for the students, since it seems to be a whole class problem rather than an individual fix.

The third assignment on Google Sheets was a great success in my eyes. Not only did it meet the standards and fill in the gaps from the Everyday Math series, the students were also engaged, discussing math with their peers, and getting hands-on experience with a tool they will use several times in the future. The students will be better prepared as they move into the Junior and Senior High School where they will understand how to use these Google Chromebook applications and where to find them on the Chromebook and their Drive accounts.

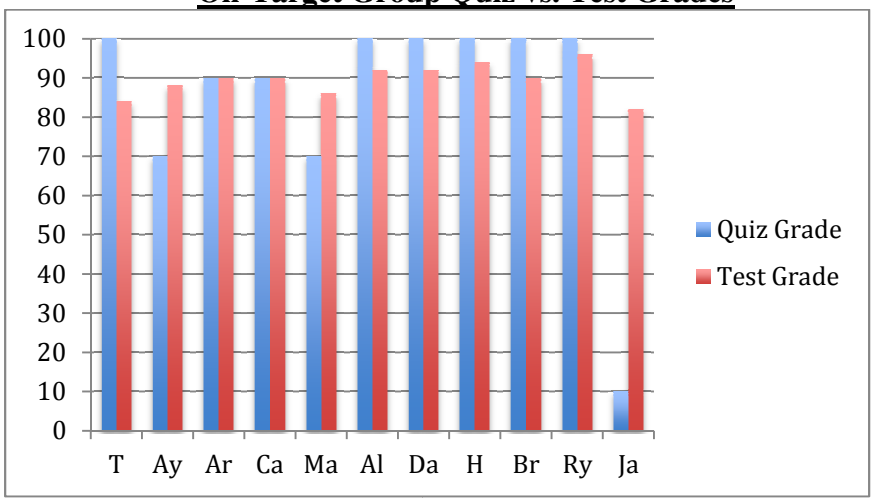
The fourth and final assignment on Google Forms was the assignment I reflected upon the most afterward. I found that creating the quiz from a teaching standpoint was very easy and a great way to create quick quizzes that will place all of the students' answers in a Google Sheets spreadsheet. I also found that sending the links out through Doctopus made it easy to differentiate the groups and make sure that I sent out the correct quizzes to the correct students. What I found to be the main issue was how poorly the readiness group did. After looking at their scores, I did more individual work with the students to differentiate based on their skill and ability level using Socratic questioning and easier examples. When the students as a class took

the end of unit test, I did see an improvement in the majority of student scores in all groups as can be seen below. The end of unit test, however, included area and volume formulas and not simply circles, though it was a decent part of the test. There were several implications towards to future that came from this study, including how differentiating worked in each assignment, what could have been done differently, and how the different applications were beneficial in the classroom.

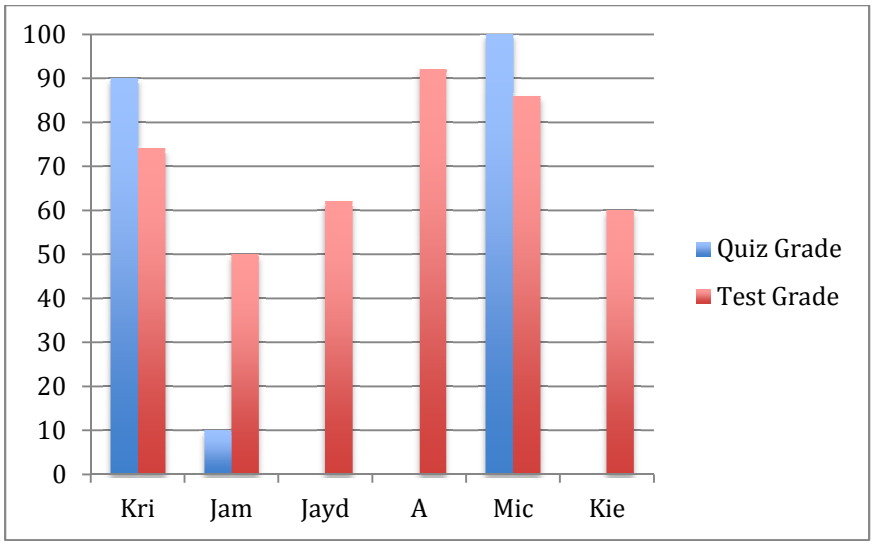
Enrichment Group Quiz vs. Test Grades



On-Target Group Quiz vs. Test Grades



Readiness Group Quiz vs. Test Grades



Overall, I was very happy with the improvement in grades, especially within the readiness group. I felt that without the differentiated quiz, I would not have been able to pinpoint each student's area of weakness and the grades would have been much lower. I also felt that the enrichment group did extremely well on the test due to the challenge they were given with their tiered quiz. The on-target group did very well and I felt as though I could have challenged them even more with the quiz. What I have found to be good for this particular group of students is not to let them know that they are in ability groups because many of them are concerned about their relationships with their peers. Being seen as too smart or too unintelligent are both negatives for my students and heavily affect their attitudes in class. By using the Chromebooks, I was able to eliminate this possibility and the students were given at-level assignments without knowing that everyone else had something different. The other good part about differentiating is that it is fluid. Students do not always end up staying in the same group they started in. Before the end of unit test, I moved H to the enrichment group, Kay and Mic to the on-target group, and Ja to the readiness group. Differentiation using Chromebooks and Google applications leads to more understanding on an individual basis and an easier administrative process.

Conclusion:

Differentiation using Chromebooks and Google applications was successfully implemented into two math and science classes at Fostoria Intermediate Elementary School. It is a highly efficient way to make sure that every student is learning at their ability level and is given the opportunity to learn through their interests and build technological skills. In further research, I would like to expand this study to an entire school building and possibly a district in order to research and analyze the progress of students, engagement in lessons, and see how teachers' views on differentiation change. Walt Disney once said, "I believe in being an innovator" (Disney, N.D.) It is up to the teachers and administrators to take the plunge and find new ways to overcome the boundaries that the education system presents.

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